



SAS[®] Event Stream Processing: Using SAS[®] Event Stream Processing Streamviewer

2020.1.5 - 2021.1.2

This document might apply to additional versions of the software. Open this document in [SAS Help Center](#) and click on the version in the banner to see all available versions.

SAS Event Stream Processing Streamviewer Overview

What Is SAS Event Stream Processing Streamviewer?

SAS Event Stream Processing Streamviewer is a web-based client that visualizes events that stream through event stream processing models. You can subscribe to individual windows on one or more ESP servers. You can display each event as a row in a table or as an element of a chart. You can save and load a collection of subscribers, their associated tables and charts, and other customized settings in *dashboards*. These dashboards are stored in a PostgreSQL database.

Accessing SAS Event Stream Processing Streamviewer

If you are using another SAS Event Stream Processing client or another SAS Viya application, you

can access SAS Event Stream Processing Streamviewer by clicking  and selecting **Visualize Event Streams**. The list of applications that appears in the applications menu depends on how your system was installed and on your access permissions.

Otherwise, to access SAS Event Stream Processing Streamviewer:

- 1 Open the following URL:

`https://name-of-ingress-host/SASEventStreamProcessingStreamviewer`

The *name-of-ingress-host* specifies the name of the host that is configured for your Kubernetes cluster Ingress. The URL above opens the application using TLS (Transport Layer Security). If you have not enabled TLS, adjust the URL accordingly.

- 2 Enter your user ID and password and click **Sign In**.

Note: If lightweight SAS Event Stream Processing was deployed, your system might not be configured to require users to sign in. In this case, the page for signing in is not displayed. Skip this step.

- 3 If SAS Event Stream Processing Streamviewer is not connected to an ESP server, you are prompted to add a new ESP server's connection details. For information about how to add an ESP server's connection details, see ["Add or Edit ESP Servers in SAS Event Stream Processing Streamviewer" on page 12](#).
- 4 After SAS Event Stream Processing Streamviewer is connected to an ESP server, the home page appears.

For information about supported web browsers and whether the device that you use to access SAS Event Stream Processing Streamviewer meets requirements, see ["Client Requirements" in System Requirements for SAS Viya](#).

Note: SAS Event Stream Processing Streamviewer does not support Microsoft Edge.

Understanding the User Interface

Dashboards

SAS Event Stream Processing Streamviewer displays events streaming through subscribed windows in tables and charts in the main area of the user interface, the dashboard. When you first access SAS Event Stream Processing Streamviewer, a dashboard appears by default.

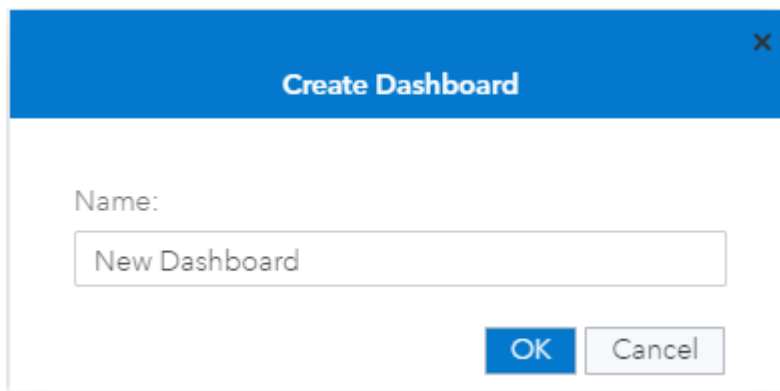
For more information, see [“Using the Dashboard” on page 5](#).

Windows

A *window* is a floating user interface element that often appears as a result of a user action. Windows generally provide a means by which to perform an action and can be closed to return you to the page from which the window was launched.

The following figure shows a window that is used to create a dashboard:

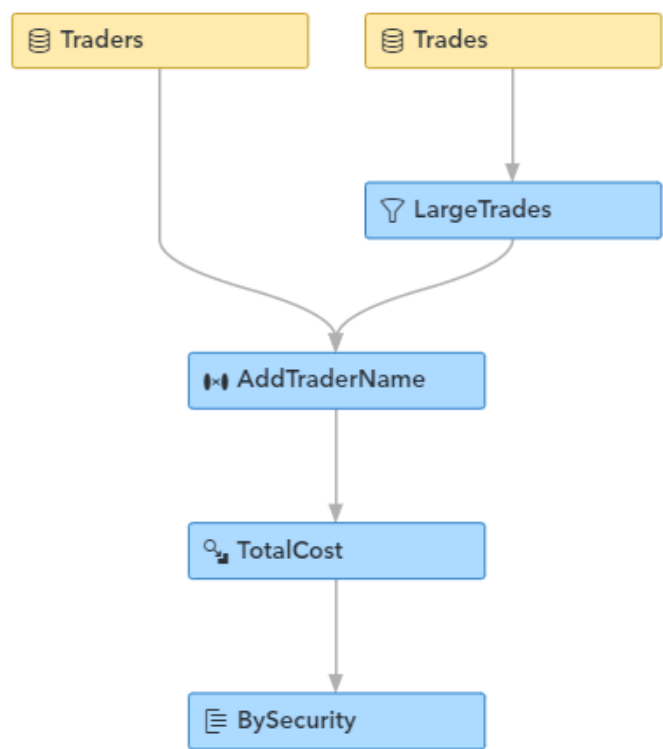
Figure 1 An Example of a User Interface Window



The figure above shows an example of a user interface element window. However, the user interface element windows in SAS Event Stream Processing Streamviewer do not have the same meaning as a SAS Event Stream Processing window. A SAS Event Stream Processing window is a component of a model's continuous query. In SAS Event Stream Processing Streamviewer, you can view SAS Event Stream Processing windows using the ESP Model Viewer. Here is an example of SAS Event Stream Processing windows displayed in the ESP Model Viewer:

An example of four SAS Event Stream Processing windows displayed in ESP Model Viewer:

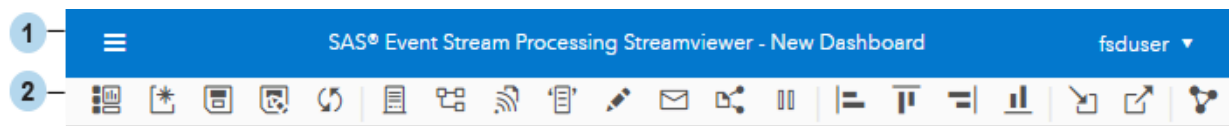
Figure 2 An Example of SAS Event Stream Processing Windows Displayed in ESP Model Viewer



Toolbars

There are two main toolbars in SAS Event Stream Processing Streamviewer, as shown in the following figure:

Figure 3 The Application Toolbars



For information about these toolbars, see the subsequent table:

Item Number	Description	Name
1	Application bar	■ Displays the applications menu, which enables you to access other SAS Viya applications. The presence of the applications menu and the list of applications within it depends on how your system was installed and on your access permissions. ■ Displays the product name. ■ Displays your user name or user ID. If SAS Event Stream Processing Streamviewer has been configured so that you do

Item Number	Description	Name
		not sign in with a user name and a password, the user ID anonymousUser is displayed. Positioning the cursor on your display name or user ID does the following: □ Provides access to Help, tutorials, and product information. □ Enables you to sign out of SAS Event Stream Processing Streamviewer (if applicable).
2	Toolbar	■ Includes buttons associated with the application. ■ Enables you to perform actions associated with an event stream.

Working with Dashboards

Overview of the Dashboard

SAS Event Stream Processing Streamviewer displays events streaming through subscribed windows in tables and charts in the main area of the user interface, the *dashboard*. For more information about configuring subscribers, see [“Managing Subscribers on the Dashboard” on page 8](#).

From the dashboard toolbar, you can configure elements of the dashboard, open previously saved dashboard configurations, and export a dashboard as an XML file. You can also add new subscribers, determine how events are displayed in the dashboard, publish data directly into your subscribed windows, and create new tables or charts.

Using the Dashboard

Each of the icons on the toolbar open a new window or perform an action:

Table 1 Dashboard Navigation Icons

Icon	Description
	Opens the Dashboards window, which lists the dashboards that are saved to the configuration database in use.
	Creates a new dashboard.

Icon	Description
	Saves the current dashboard.
	Creates a new dashboard with a user-specified name using the properties of the current dashboard.
	Reloads the current dashboard.
	Opens the ESP Servers window. The ESP Servers window enables you to add new ESP servers and edit existing ESP servers that publish events to subscriber windows in SAS Event Stream Processing Streamviewer. For more information, see “ESP Servers in SAS Event Stream Processing Streamviewer” on page 10.
	Opens the ESP Model Viewer window. From this window, you can load and view an ESP model from any project, continuous query, and ESP servers connected to SAS Event Stream Processing Streamviewer. You can also subscribe to available model windows for use in the dashboard. For more information about the ESP Model Viewer, see “Using the ESP Model Viewer” on page 16.
	Opens the ESP Subscribers window. From this window, you can add new subscribers from existing ESP servers, edit the properties of an existing subscriber, and create new tables for existing subscribers. For more information about subscribers, see “Managing Charts and Tables on the Dashboard” on page 14.
	Opens the Dashboard Fields window. From the Dashboard Fields window, you can define the name and size of the columns of event data in your dashboard's tables and charts.
	Opens the Edit Dashboard window, which provides options for editing the dashboard's appearance.
	Opens your email client with a URL to your current dashboard, which can be sent to someone else for viewing.
	Opens the ESP Stream Publish window. From here, you can publish events directly into subscribed Source windows by listing event data in CSV format or by providing the location of a CSV data file on the ESP server. If you are providing the location of a CSV data file, you must enter <code>file://</code> before the file path. You can also specify the date format of your publishing stream and the event block size.
	Pauses all data streaming into the dashboard.
	Aligns all selected charts with the selected chart farthest to the left of the dashboard. To select multiple charts, hold the Ctrl key and click the charts that you want to select.
	Aligns all selected charts with the selected chart farthest to the top of the dashboard. To select multiple charts, hold the Ctrl key and click the charts that you want to select.
	Aligns all selected charts with the selected chart farthest to the right of the dashboard. To select multiple charts, hold the Ctrl key and click the charts that you want to select.

Icon	Description
	Aligns all selected charts with the selected chart farthest to the bottom of the dashboard. To select multiple charts, hold the Ctrl key and click the charts that you want to select.
	Opens the Import Data window. From this window, you can import dashboard configuration data from a local file.
	Opens the Export Data window. This window displays XML code that corresponds to all dashboards in your SAS Event Stream Processing Streamviewer configuration.
	Opens the Model Visualizer in a new tab. From the Model Visualizer, you can view a running event stream processing model. For more information about the Model Visualizer, see “Visualizing ESP Models” on page 18 .

Exporting SAS Event Stream Processing Streamviewer Data

Click  on the dashboard pane to export SAS Event Stream Processing Streamviewer data to a file that can be imported to an instance of SAS Event Stream Processing Streamviewer running on another server. The Export Data window appears. This window shows all dashboard configurations in XML format. Copy the XML configuration from the Export Data window to save it to a local file. Use the local file with the XML export data to import the data to a server running another instance of SAS Event Stream Processing Streamviewer.

IMPORTANT This functionality is not supported if you are using an ESP server on a Kubernetes cluster.

Importing SAS Event Stream Processing Streamviewer Data

You can import data to SAS Event Stream Processing Streamviewer directly from a file:

- 1 Click  on the toolbar.
- 2 In the Import Data window, complete the following fields:

Note: The imported file should have an XML structure similar to the following. This is the output from the instructions in [“Exporting SAS Event Stream Processing Streamviewer Data” on page 7](#).

```
<rows continue-on-error='false'>
```

```

<insert table='streamviewer_server'>
  <values>
    <value column='id'>e01b157a0318250a09408857a472898e</value>
    <value column='name'>bserve</value>
    ...
  </values>
</insert>
<insert table='streamviewer_dashboard'>
  <values>
    <value column='id'>e01ab91c-0318250a-09408857-455cf343</value>
    <value column='name'>sample</value>
    <value column='creation_time'>1485523728055</value>
    ...
  </values>
</insert>
...
</rows>

```

a Click **Choose File**.

b Navigate to the file that you want to import and click **OK**.

The **File that contains dashboard configuration data** field is populated with the file name of the file that you want to import.

3 Click **OK** to close the Import Data window.

IMPORTANT This functionality is not supported if you are using an ESP server on a Kubernetes cluster.

Managing Subscribers

Managing Subscribers on the Dashboard

You can edit existing subscribers and add new subscribers from the Subscribers window. To open the Subscribers window from the dashboard, click .

Subscribers in SAS Event Stream Processing Streamviewer use the SAS Event Stream Processing WebSocket Publish/Subscribe API to communicate with the ESP server. For more information, see [“Creating and Using the JavaScript WebSocket Subscriber” in SAS Event Stream Processing: WebSocket API Reference](#).

To create a new table on your current dashboard for an existing subscriber, select the subscriber and click . For more information, see [“Managing Charts and Tables on the Dashboard” on page 14](#).

Create or Edit Subscribers on the Dashboard

- 1 Click .

The Subscribers window appears.

- 2 To create a new subscriber, click .

The New ESP Subscriber window appears.

or

To edit an existing subscriber, select the subscriber and click .

The Edit ESP Subscriber window appears.

- 3 Enter or change the following settings as required:

Note: If you are changing the details of an existing subscriber's settings, you cannot change the subscriber's mode, ESP server, project, continuous query, or window.

- a In the **Name** field, enter a name for the subscriber.
- b In the **ESP server** drop-down list, select the relevant ESP server.
- c In the **Project** drop-down list, select the project that contains the window that you want to subscribe to.
- d In the **Continuous query** drop-down list, select the continuous query that contains the window that you want to subscribe to.
- e In the **Window** drop-down list, select the window that you want to subscribe to.
- f In the **Mode** drop-down list, select one of the following subscriber modes:
 - **Updating** – An updating subscriber uses a set of events called an event page. The subscriber maintains the keys of these events. When the subscriber gets an event notification and the event is not in the current page, it is ignored. When it is in the current page, the WebSocket client is notified of the update.
 - **Streaming** – A streaming subscriber sends each event for which it receives a notification. These events are put into a list as they are received and then sent to the WebSocket client. The list is trimmed to the current page size of the subscriber before it is sent. When a large number of events are streaming at a high rate, some events are dropped. The WebSocket client gets a sample of the total set of events streaming through the system.
- g In the **Page size** field, enter the number of events to be placed on each event page. The page size determines the number of events that the application retrieves from the ESP server and then is displayed in a table or chart on the dashboard. The default page size is 50 events.
- h In the **Delivery interval** field, enter an interval period, in milliseconds, for how often events are retrieved from the ESP server. Specifying a delivery interval can improve performance for subscribed windows with large quantities of streaming events.

Note: Modifying the **Page size** and **Delivery interval** settings can significantly affect the application's performance.

- i In the **Filter** field, enter a functional filter to apply to the events being processed by the subscriber. For example, if you want to subscribe to stock transactions for IBM and AT&T, you might enter `in(symbol, 'IBM', 'T')`.
 - j In the **Sort field** drop-down list, select the sort field.
 - k In the **Sort direction** drop-down list, select the sort method for events that are streamed through a window.
- 4 Click **OK**.
 - 5 Click **Close**.

Delete a Subscriber on the Dashboard

- 1 Click .
- 2 In the ESP Subscribers window, select the subscriber that you want to delete and click .
- 3 Click **OK** to confirm the deletion of the subscriber from the application.
- 4 Click **Close**.

Managing ESP Servers in SAS Event Stream Processing Streamviewer

ESP Servers in SAS Event Stream Processing Streamviewer

SAS Event Stream Processing Streamviewer enables you to view events streaming through a model from more than one ESP server at a time. Before subscribing to and visualizing event streams in the dashboard, you must configure your ESP server connections.

In SAS Event Stream Processing Streamviewer, ESP servers that exist on the same Kubernetes cluster as SAS Event Stream Processing Streamviewer are automatically populated in the ESP Servers window. For more information, see [“Kubernetes Clusters in SAS Event Stream Processing Streamviewer” on page 11](#).

When starting an ESP server that is on an edge server, you must specify the HTTP port and the publish/subscribe port to connect to the server from the application. For more information about starting an ESP server, see [SAS Event Stream Processing: Using the ESP Server in an Edge Environment](#).

Note: SAS Event Stream Processing Streamviewer displays events for ESP servers at the same release level as SAS Event Stream Processing Streamviewer. Connecting the application to a server running a previous version of SAS Event Stream Processing is not supported and can cause unpredictable results.

The ESP Servers window enables you to view, add, edit, test, and delete ESP server connections details. To open the ESP Servers window from the dashboard or the ESP Model Viewer window, click

 on the pane at the top of the page. The ESP Servers window shows the following information in a table:

- The name of the ESP server connection. In the Name column, ESP servers in the same Kubernetes cluster as SAS Event Stream Processing Streamviewer are marked with the following icon: .
- The host name identifying the ESP server's location.
- The ESP server's HTTP port.
- The statistics interval, measured in seconds, determines the reporting interval for the server to send CPU usage statistics to SAS Event Stream Processing Streamviewer.
- The minimum CPU usage percentage for windows to be reported in CPU usage statistics.

To reload the table of ESP servers, click .

Kubernetes Clusters in SAS Event Stream Processing Streamviewer

SAS Event Stream Processing includes the ability to load and run projects on a Kubernetes cluster. When a project is running in a Kubernetes cluster, an ESP server is created on demand. When the project is stopped, the ESP server is deleted from the Kubernetes cluster. Otherwise, an ESP server in a Kubernetes cluster behaves in the same way as an ESP server that is running on an edge server.

In SAS Event Stream Processing Streamviewer, ESP servers that exist on the same Kubernetes cluster as SAS Event Stream Processing Streamviewer are automatically populated in the ESP Servers window. ESP servers in a Kubernetes cluster are marked with the  icon in the Name

column of the table in the ESP Servers window. To access the ESP Servers window, click . For more information about connecting to ESP servers, see [“ESP Servers in SAS Event Stream Processing Streamviewer” on page 10](#).

Add or Edit ESP Servers in SAS Event Stream Processing Streamviewer

- 1 Open the ESP Servers window from the dashboard or the ESP Model Viewer window by clicking  on the toolbar.

The ESP Servers window appears.

- 2 To add an ESP server connection to the list, click .

Note: ESP servers that exist on the same Kubernetes cluster as SAS Event Stream Processing Streamviewer are automatically populated in the ESP Servers window. For more information, see [“Kubernetes Clusters in SAS Event Stream Processing Streamviewer”](#) on page 11.

The New ESP Server window appears.

To edit the details of an existing ESP server's connection, select an ESP server and click .

The Edit ESP Server window appears.

Complete the following fields to set up or edit an ESP server connection:

- a In the **Name** field, specify a unique string for the name of the ESP server connection.
 - b In the **Host** field, enter the ESP server's location.
 - c In the **HTTP port** field, enter the server's HTTP port.
 - d In the **Statistics interval** field, enter the statistics interval, measured in seconds. This field determines the reporting interval for the server to send CPU usage statistics to SAS Event Stream Processing Streamviewer.
 - e In the **Minimum CPU %** field, specify the minimum CPU usage percentage for windows to be reported in CPU usage statistics.
 - f Select the **Connect using SSL** check box if the ESP server uses a secure connection.
- 3 Click **OK**.

Delete an ESP Server's Details from SAS Event Stream Processing Streamviewer

Deleting an ESP server's details from the application removes the ESP server's entry from the table in the ESP Servers window. Deleting an ESP server's details from SAS Event Stream Processing Streamviewer can be useful if the table contains ESP servers that are no longer used. You can delete the details of an ESP server that is still running from the application. Deleting an ESP server's details does not delete the ESP server itself. Only the ESP server's details are deleted from SAS Event Stream Processing Streamviewer.

If your ESP server was created as part of a Kubernetes cluster, the ESP server is automatically deleted when the project is stopped on the ESP server. For more information, see [“Kubernetes Clusters in SAS Event Stream Processing Streamviewer” on page 11](#).

To delete a specific ESP server from the table:

- 1 Open the ESP Servers window from the dashboard or the ESP Model Viewer window by clicking  on the toolbar.
The ESP Servers window appears.
- 2 On the ESP Servers window, select the ESP server whose details you want to delete and click .
- 3 Click **OK** to confirm the deletion of the ESP server's details from the application.

Retrieve CPU Usage Statistics for Models Running on an ESP Server

- 1 Open the ESP Servers window from the dashboard or the ESP Model Viewer window by clicking  on the toolbar.
The ESP Servers window appears.
- 2 Select the relevant server and click .
- 3 Click **Close** to close the ESP Servers window.
A table reporting CPU usage statistics appears on the dashboard.

Monitor Events Flowing through an ESP Server

- 1 Open the ESP Servers window from the dashboard or the ESP Model Viewer window by clicking  on the toolbar.
The ESP Servers window appears.
- 2 Select the relevant ESP server and click .
- 3 Click **Close** to close the ESP servers window.
An Event Flow Diagram is shown on the dashboard enabling you to view incoming events flowing through your model.

Verify Your ESP Server's Connection

- 1 Open the ESP Servers window from the dashboard or the ESP Model Viewer window by clicking  on the toolbar.

The ESP Servers window appears.

- 2 Select the ESP server whose connection you want to verify and click .

A new window appears, informing you if your connection test has been successful. This test can help verify the information that you entered only if the ESP server is active.

- 3 Click **OK** to close the window.
- 4 Click **Close** to close the ESP Servers window.

Note: If the ESP server is not active, you can still add the ESP server information to the configuration for SAS Event Stream Processing Streamviewer.

Working with Charts And Tables

Managing Charts and Tables on the Dashboard

After you create a new subscriber, a table of events streaming to the subscribed window appears in the dashboard. You can change the table's display type and create other visual components based on the same stream of events. You can organize data in tables and charts by key fields or by classes. The types of charts available for a subscriber depend on the subscriber window's key and non-key field types. For example, series plots require subscriber windows to have numeric key fields. Time series plots require a time key field. Some chart types require the subscriber window to have numeric non-key fields.

To manage charts and tables on the dashboard:

- 1 Prepare and run your model:
 - a Open SAS Event Stream Processing Studio and sign in with your credentials. For more information, see [“Accessing SAS Event Stream Processing Studio” in SAS Event Stream Processing: Using SAS Event Stream Processing Studio](#).
 - b Create a new project. For more information, see [“Create a Project” in SAS Event Stream Processing: Using SAS Event Stream Processing Studio](#).

Import the relevant project to SAS Event Stream Processing Studio. For more information, see [“Import a Project” in SAS Event Stream Processing: Using SAS Event Stream Processing Studio](#).

- c Run the project in test mode. For more information, see [“Testing Models in SAS Event Stream Processing Studio” in SAS Event Stream Processing: Using SAS Event Stream Processing Studio](#).

Note: Alternatively, you can run the project using SAS Event Stream Manager. You can also run the project using the controls on the **ESP Servers** page in SAS Event Stream Processing Studio.

- 2 In SAS Event Stream Processing Streamviewer, create subscribers for the relevant windows. For more information, see [“Create or Edit Subscribers on the Dashboard” on page 9](#).

A table of events streaming to the subscribed window appears in the dashboard.

- 3 Click  at the top right of a table or chart to display a menu of options. This menu displays the following options:

Edit

Opens the Modify Chart window. From this window, you can change the type of table or chart that you have selected and its title and appearance.

New chart

Opens the New Chart window. From this window, you can create a new table or chart based on the selected subscriber.

Filter

Filters the events displayed in a table or chart.

Note: Represent floating-point numbers that are used in filters in US decimal format.

Close

Removes the table or chart from the dashboard.

After a table or chart is displayed on the dashboard, you can move it by dragging it to the desired position. You can resize a table or chart by grabbing the lower right corner and dragging it. Anytime that you click on a table or chart, it appears in front of the other components on the screen.

All tables and charts connected to a subscriber are synchronized. When you apply a filter to one table or chart, it affects all tables and charts connected to the same subscriber. Similarly, when you sort a table, all charts connected to the same subscriber are sorted accordingly.

Using the Model Viewer

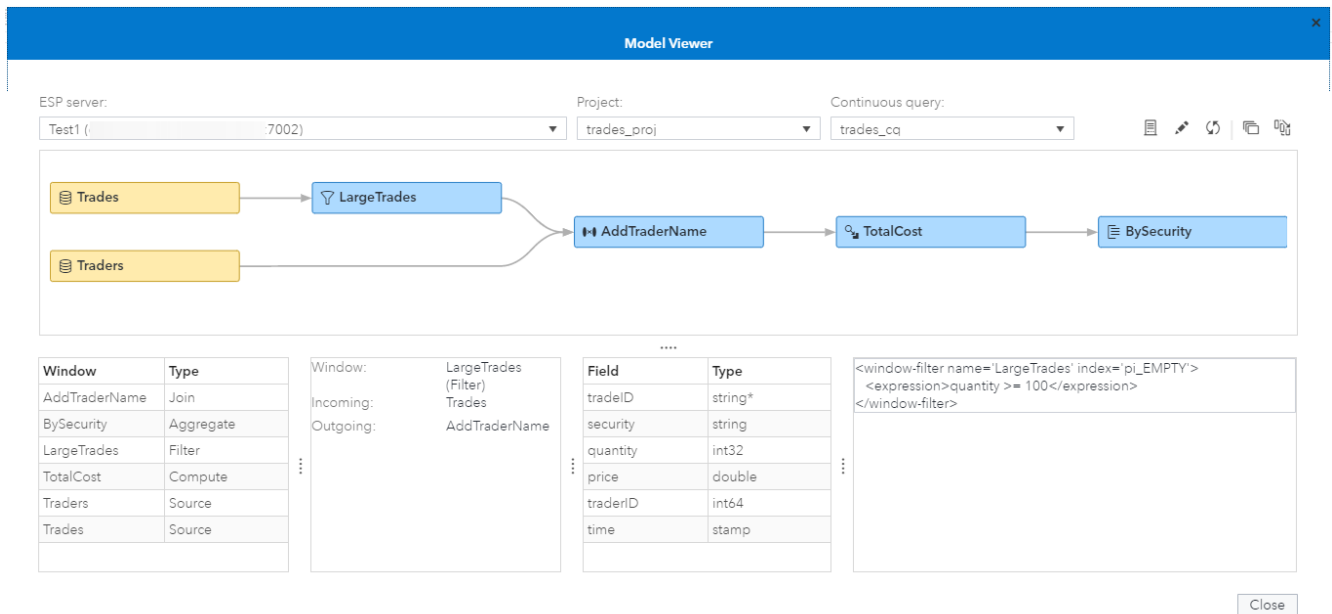
Overview

Model Viewer enables you to view SAS Event Stream Processing models running on an ESP server in real-time. A model specifies how SAS Event Stream Processing analyzes and then transforms input event streams into meaningful results. To open the ESP Model Viewer from the dashboard, click



The figure below shows an example of a running model being displayed in Model Viewer:

Figure 4 Model Viewer Displaying a Model Running on an ESP Server



Clicking a window on the diagram populates the tables located at the bottom of the Model Viewer with details about the window. These details include the window's incoming and outgoing data sources, its schema, and its corresponding XML code.

You can create a subscriber to monitor a selected window in the dashboard. There are two subscriber modes:

Updating

A subscriber in Updating mode retrieves events from the ESP server whose keys correspond to the events currently displayed in a table or chart on the dashboard.

Streaming

A subscriber in Streaming mode receives all events from the ESP server of the subscriber's page size in intervals specified in the subscriber settings. For more information about specifying page sizes and intervals in the subscriber settings, see ["Managing Subscribers on the Dashboard" on page 8](#).

For more information about how to use ESP Model Viewer, see ["Using the ESP Model Viewer" on page 16](#).

Using the ESP Model Viewer

- 1 Use the ESP Model Viewer to view event stream processing models and subscribe to windows. To open the ESP Model Viewer from the dashboard, click .

Note: To view your model in ESP Model Viewer, you must add the ESP server that is running the model to SAS Event Stream Processing Streamviewer. If you have not already done this, click  to open the ESP Servers window where you can add the relevant ESP server.

- 2 Select the relevant ESP server, project, and continuous query using the drop-down lists in the top left of the ESP Model Viewer:
 - a From the **Server** drop-down list, select the ESP server that is running the model that you want to view.

Note: If you have added the relevant ESP server to the application, and the ESP server does not appear in the drop-down list, click  to reload the drop-down list.

- b From the **Project** drop-down list, select the project that contains the model that you want to view.
 - c From the **Contquery** drop-down list, select the relevant continuous query.
- 3 If required, click  to reload ESP Model Viewer.
- 4 The windows in the selected continuous query and their associated edges are diagrammed in the content area. Click  to change the orientation of the model and the appearance of the edges.

The Edit Model Display Properties window appears.

- a In the **Link Type** field, select one of the following link types from the drop-down list:
 - Curved – Displays edges as curved.
 - Orthogonal – Displays edges using right angles.
 - Direct – Displays edges as straight lines.
 - b In the **Model Orientation** field, select one of the following orientation types from the drop-down list:
 - Horizontal – Orients your model in a horizontal format.
 - Vertical – Orients your model in a vertical format.
 - c Click **OK**.
- 5 If required, add a subscriber to the dashboard:
 - a To create an Updating subscriber, select a window and click  on the toolbar.
A message appears, informing you that the updating subscriber has been added to the dashboard.
 - b To create a Streaming subscriber, select a window and click  on the toolbar.
A message appears, informing you that the streaming subscriber has been added to the dashboard.
- 6 After you have finished making your changes, click **Close** to close the ESP Model Viewer and return to the dashboard.

Using the Model Visualizer

Visualizing ESP Models

The ESP Model Visualizer enables you to view models that exist on an ESP server or in a static file.

- 1 Before you can run the ESP Model Visualizer, you must perform the following steps in SAS Event Stream Processing Studio:

- a Open SAS Event Stream Processing Studio and sign in with your credentials. For more information, see [“Accessing SAS Event Stream Processing Studio” in SAS Event Stream Processing: Using SAS Event Stream Processing Studio](#).
- b Create a new project. For more information, see [“Create a Project” in SAS Event Stream Processing: Using SAS Event Stream Processing Studio](#).

Or

Import the relevant project to SAS Event Stream Processing Studio. For more information, see [“Import a Project” in SAS Event Stream Processing: Using SAS Event Stream Processing Studio](#).

- c Run the project in test mode. For more information, see [“Testing Models in SAS Event Stream Processing Studio” in SAS Event Stream Processing: Using SAS Event Stream Processing Studio](#).

Note: Alternatively, you can run the project using SAS Event Stream Manager. You can also run the project using the controls on the **ESP Servers** page in SAS Event Stream Processing Studio.

- 2 On the SAS Event Stream Processing Streamviewer dashboard, click  to open the ESP Model Visualizer.
- 3 To view a model in a local XML file, drag and drop the file into the content portion of the window.
- 4 To view a model on a running ESP server, select the relevant ESP server from the **ESP server** drop-down list.

The **ESP server URL** field is populated with the URL of the ESP server. If necessary, you can edit this URL. If you decide to edit this URL, ensure you enter the correct security protocol. For secure connections, enter `https://host:port` as the URL. Otherwise, enter `http://host:port` as the URL.

- 5 Click .

The **Project** and **Continuous query** fields are populated with the default values. You can select other continuous queries to load if they are available in the project.

- 6 After you load a model in the visualizer, the windows in the model and their associated edges are shown in the content area. To control the appearance of the model in the content area, modify the **Orientation** and **Link type** settings located under the **Project** and **Continuous query** fields. For more information, see [“Using the ESP Model Viewer” on page 16](#).
- 7 Click on any window to display its XML definition in the content area at the bottom of the visualizer window.

Windows with a half-filled red circle in the bottom right corner are stateless and have an index of `pi_EMPTY`. Windows with a green check in the bottom right corner have an index other than `pi_EMPTY` and are stateful.

Example: Create a Stock Market Trades Dashboard

Overview

This example shows how you can use SAS Event Stream Processing Streamviewer to visualize an active event stream. The example uses a model that identifies large securities transactions and the traders who were involved in those trades. This example demonstrates how you can use SAS Event Stream Processing Streamviewer to build a trade activity dashboard to monitor the large securities transactions.

This example uses the same files as the Processing Trades example for SAS Event Stream Processing Studio. See [“Processing Trades” in SAS Event Stream Processing: Using SAS Event Stream Processing Studio](#).

This example uses three files listed below:

- The XML file (`trades.xml`) associated with this example.
- `trades.csv` is an input file. This file contains events relating to securities transactions.
- `traders.csv` is an input file. This file contains events relating to the traders involved in the securities transactions.

For demonstration purposes, this example uses file connectors that read from comma-separated value (CSV) data located in static files. When a model similar to the one used in this example is deployed in a live environment, real-time data sources might be used instead. Before attempting to follow these steps in this example to create a trade activity dashboard, ensure that the `trades.xml` model is working correctly in test mode. This includes ensuring that the model's publisher connectors are correctly configured. The `trades.csv` and `traders.csv` files must be in a location on your file system where they can be accessed by the application.

This model runs on an ESP server. Before you build a trade activity dashboard in SAS Event Stream Processing Streamviewer, ensure you have a running and configured ESP server in SAS Event Stream Processing Studio.

Example Steps

Prepare the Trades Project in SAS Event Stream Processing Studio

Before you can create a dashboard in SAS Event Stream Processing Streamviewer, you must perform the following steps in SAS Event Stream Processing Studio:

- 1 Open SAS Event Stream Processing Studio and sign in with your credentials. For more information, see [“Accessing SAS Event Stream Processing Studio” in SAS Event Stream Processing: Using SAS Event Stream Processing Studio](#).
- 2 If you are using an edge environment, perform the following steps:
 - a Ensure that an ESP server is available and configured in SAS Event Stream Processing Studio. For more information about how to start an ESP server in an edge environment, see [“Starting the ESP Server in an Edge Environment” in SAS Event Stream Processing: Using the ESP Server in an Edge Environment](#). For more information on how to add an ESP server to SAS Event Stream Processing Studio, see [“Add or Edit an ESP Server to Run on an Edge Server” in SAS Event Stream Processing: Using SAS Event Stream Processing Studio](#).
 - b Make a note of the configured ESP server’s credentials. Later in the example steps, you must register this ESP server’s connection details in SAS Event Stream Processing Streamviewer.

If you are using a Kubernetes cluster, skip this step. An ESP server is created automatically on the Kubernetes cluster and you are not required to manually create it.

- 3 If you have not already done so, import the trades.xml project to SAS Event Stream Processing Studio. For more information, see [“Import a Project” in SAS Event Stream Processing: Using SAS Event Stream Processing Studio](#).

Sign In to SAS Event Stream Processing Streamviewer

Open SAS Event Stream Processing Streamviewer and sign in with your credentials. For more information, see [“Accessing SAS Event Stream Processing Streamviewer” on page 2](#).

The application opens. If you have not previously added an ESP server’s connection details to SAS Event Stream Processing Streamviewer, the New ESP Server window appears. This window enables you to add a previously created ESP server’s connection details to SAS Event Stream Processing Streamviewer.

Add an ESP Server to SAS Event Stream Processing Streamviewer

In the New ESP Server window, add the connection details of the ESP server that you added earlier. If you are using a Kubernetes cluster or you have already added a working ESP server's connection details to SAS Event Stream Processing Streamviewer, skip this step.

- 1 In the **Name** field, enter a name for the ESP server connection that you are adding.
- 2 In the **Host** field, enter the host name of the ESP server that you added earlier.
- 3 In the **HTTP Port** field, enter the HTTP port number of the ESP server that you added earlier.
- 4 Click **OK** to close the window.
- 5 If it is not already selected, select the ESP server you just added and click  .

A window appears, specifying whether a connection to the ESP server could be established. If a connection with the ESP server could not be established, repeat the process of adding a connection to the ESP server that you created.

- 6 Click **Close** to close the New ESP Server window.

Run the Project in Test Mode

In SAS Event Stream Processing Studio, run the project in test mode. For more information, see [“Testing Models in SAS Event Stream Processing Studio” in SAS Event Stream Processing: Using SAS Event Stream Processing Studio](#).

Add Subscribers to the Model

In SAS Event Stream Processing Streamviewer, add some subscribers to the model:

- 1 Click  .
The Subscribers window appears.
- 2 Click  .
The New ESP Subscriber window appears.
- 3 In the **Name** field, enter `LargeTrades`.
- 4 In the **ESP server** field, confirm that the ESP server that you added is selected by default. If the ESP server that you added earlier does not appear in the drop-down list, refresh the list of available ESP servers, click  .
- 5 In the **Project** field, confirm that `trades_proj` is selected by default.
- 6 In the **Continuous query** field, confirm that `trades_cq` is selected by default.
- 7 In the **Window** field, select `LargeTradesCopy` from the drop-down list.

22

8 In the **Mode** field, confirm that **Updating** is selected by default.

9 Accept all other default selections.

10 Click **OK**.

A message appears, indicating that a new item has been added to the dashboard.

11 Click .

The New ESP Subscriber window appears.

12 In the **Name** field, enter `TotalCost`.

13 In the **ESP server** field, confirm that the ESP server that you added is selected by default. If the ESP server that you added earlier does not appear in the drop-down list, refresh the list of available ESP servers, click .

14 In the **Project** field, confirm that `trades_proj` is selected by default.

15 In the **Continuous query** field, confirm that `trades_cq` is selected by default.

16 In the **Window** field, select **TotalCostCopy** from the drop-down list.

17 In the **Mode** field, confirm that **Updating** is selected by default.

18 Accept all other defaults.

19 Click **OK**.

A message appears, indicating that a new item has been added to the dashboard.

20 Click .

The New ESP Subscriber window appears.

21 In the **Name** field, enter `BySecurity`.

22 In the **ESP server** field, confirm that the ESP server that you added is selected by default. If the ESP server that you added earlier does not appear in the drop-down list, refresh the list of available ESP servers, click .

23 In the **Project** field, confirm that **Trades** is selected by default.

24 In the **Continuous query** field, confirm that `trades_cq` is selected by default.

25 In the **Window** field, select **BySecurity** from the drop-down list.

26 In the **Mode** field, confirm that **Updating** is selected by default.

27 Accept all other defaults.

28 Click **OK**.

A message appears, indicating that a new item has been added to the dashboard.

29 Click **Close**.

You are returned to the dashboard. The dashboard items are updated to display events associated with the window. For each window that you have subscribed to, this information appears in a table.

Examine the Model in ESP Model Viewer

Examine the model in the ESP Model Viewer:

- 1 Click .

The Model Viewer window appears and displays a graphical representation of the model currently running on the ESP server selected.

- 2 If a graphical representation of your model does not appear in the ESP Model Viewer, refresh ESP Model Viewer. Click .

- 3 To change the model's display properties, click .

The Edit Model Display Properties window appears.

- 4 The model graph is too large to fit on a vertical view. To change to a horizontal orientation, in the **Orientation** field, select **Horizontal** from the drop-down list.

- 5 In the **Link Type** field, select **Curved** from the drop-down list.

- 6 Click **OK**.

The model now appears in a horizontal orientation with curved edges.

- 7 Click the Trades window on the diagram.

Clicking a window on the diagram populates the tables located at the bottom of the ESP Model Viewer with details about the window. These details include the window's incoming and outgoing data sources, its schema, and its corresponding XML code. The window that you selected is highlighted with a black border.

- 8 In the table in the bottom left corner, click **TotalCostCopy**.

The TotalCostCopy window is selected. Clicking a row in the table is an alternative method of selecting a window on the diagram.

- 9 Click **Close**.

Customize the Dashboard

Add a pie chart to the dashboard to display the total cost of purchase and the quantity of shares purchased for each trade:

- 1 Click  in the top right corner of the TotalCostCopy table.

- 2 Click **New chart**.

The New Chart window appears. By default the settings for a vertical bar chart appear.

- 3 In the list of options on the left, click **Pie Chart** to display the settings for a pie chart.

- 4 In the **Title** field, enter **Total Cost/Quantity**.

- 5 In the **Class Values** field, confirm that **tradeID** is selected.

- 6 In the **Values** field, press and hold Ctrl and select **quantity** and **totalCost** from the list.

7 In the **Orientation** field, confirm that **Horizontal** is selected.

8 Select the **Donut** check box.

9 Confirm that the **Show legend** check box is selected.

10 Click **OK**.

The pie chart appears on the dashboard.

11 Click a segment of the pie chart.

The segment is highlighted on the pie chart.

12 Position the cursor over the segment of the pie chart that you highlighted.

A message box appears, specifying the quantity of shares purchased or the total cost of the trade, and the associated trade ID. The inner section of the pie chart displays the total cost per trade. The outer section of the pie chart displays the quantity of shares purchased per trade.

Add a bubble plot to the dashboard to display to the total cost of purchase, the quantity of shares purchased, and the trader ID of the trader:

1 Click  in the top right corner of the TotalCostCopy table.

2 Click **New chart**.

The New Chart window appears. By default the settings for a vertical bar chart appear.

3 In the list of options on the left, click **Bubble Plot** to display the settings for a bubble plot.

4 In the **Title** field, enter `TradesBubble`.

5 In the **X axis** field, select **totalCost** from the drop-down list.

6 In the **Y axis** field, select **traderID** from the drop-down list.

7 In the **Size** field, select **quantity** from the drop-down list.

8 In the **Orientation** field, select **Horizontal** from the drop-down list.

9 Confirm that the **X Axis Title** check box is selected.

10 Select the **Y Axis Title** check box.

11 Confirm that the **Show Legend** check box is selected.

12 Accept all other defaults.

13 Click **OK**.

The bubble plot appears on the dashboard.

14 Click a bubble on the bubble plot.

The bubble is highlighted on the bubble plot.

15 Position the cursor over the bubble that you highlighted.

A message box appears, specifying the quantity of shares purchased, the total cost of the trade, and the associated trader ID.

Add a line chart to display the total cost for each trade:

1 Click  in the top right corner of the TotalCostCopy table.

- 2 Click **New chart**.

The New Chart window appears. By default the settings for a vertical bar chart appear.

- 3 In the list of options on the left, click **Line Chart** to display the settings for a line chart.

- 4 In the **Title** field, enter `Tradesline`.

- 5 In the **Values** field, select **totalCost**.

- 6 Confirm that the **X Axis Title** check box is selected.

- 7 Select the **Y Axis Title** check box.

- 8 Confirm that the **Show Legend** check box is selected.

- 9 Accept all other defaults.

- 10 Click **OK**.

The line chart appears on the dashboard.

- 11 Position the cursor over a point on the line chart.

A message box appears, specifying the total cost of the trade and the associated trader ID.

Save the Dashboard and Stop the Project

Save the Dashboard:

- 1 Click .

The Save Dashboard As window appears.

- 2 In the **Name** field, enter `TradesDashboard`.

- 3 Click **OK**.

- 4 In SAS Event Stream Processing Studio, stop the project in test mode. For more information, see [“Testing Models in SAS Event Stream Processing Studio” in SAS Event Stream Processing: Using SAS Event Stream Processing Studio](#).

The project stops and is unloaded from the ESP server. The dashboard items in SAS Event Stream Processing Streamviewer stop showing events.

Example: Create a Sailing Data Dashboard

Prepare the Example Files for Use

- 1 If you have not already done so, download the SAS Event Stream Processing Studio examples package from <https://support.sas.com/downloads/package.htm?pid=2421> and extract its contents on your computer.
- 2 In the examples package, navigate to the `/FurtherExamples/sailing` directory.
- 3 Save the following files on the server on which SAS Event Stream Processing is running:
 - `geoArea.csv`
 - `boat1.csv`
 - `boat2.csv`
 - `boat3.csv`
 - `boat4.csv`
- 4 If you want to run the model without following the steps to create it, import the `sailing_example.xml` file to SAS Event Stream Processing Studio. For more information, see [“Import a Project” in SAS Event Stream Processing: Using SAS Event Stream Processing Studio](#).

For more information on the files listed above, see [“Overview” on page 26](#).

Overview

This example shows how you can use SAS Event Stream Processing Streamviewer to visualize an event stream of data obtained from a set of boats. The model identifies two geographical areas of interest. One area is an exclusion zone that the boats identified are not permitted to enter. The other is an area where a speed restriction has been applied. For convenience, it is recommended that you import the preprepared model XML file to SAS Event Stream Processing Studio.

This example uses six files listed below:

- The XML file (`sailing_example.xml`) is the project used in the example.
- `geoArea.csv` is an input file. This file contains events relating to the defined areas of interest.
- `boat1.csv` is an input file. This file contains the event stream of boat 1. The event stream contains time-stamped geographical coordinates of the boat's movements.

Note: For demonstration purposes, the time-stamped geographical coordinates used in this example are represented as strings.

- `boat2.csv` is an input file. This file contains the event stream of boat 2. The event stream contains time-stamped geographical coordinates of the boat's movements.
- `boat3.csv` is an input file. This file contains the event stream of boat 3. The event stream contains time-stamped geographical coordinates of the boat's movements.
- `boat4.csv` is an input file. This file contains the event stream of boat 4. The event stream contains time-stamped geographical coordinates of the boat's movements.

For demonstration purposes, this example uses CSV files containing historical data. When a model similar to the one used in this example is deployed in a live environment, real-time data sources might be used instead. Before attempting to follow the steps in this example to create a sailing data dashboard, ensure that the model is working correctly in test mode. This includes ensuring that the model's publisher connectors are correctly configured. The CSV files listed previously must be in a location on the server on which SAS Event Stream Processing is running.

This model runs on an ESP server. Before you build a sailing data dashboard in SAS Event Stream Processing Studio, ensure that the ESP server is running and configured in SAS Event Stream Processing Studio. The model contains the following windows:

- Four Source windows that receive event streams from the four boats identified: Boat1, Boat2, Boat3, and Boat4
- One Source window that receives an event stream defining the areas of interest that the boats are not permitted to enter: Areas_Of_Interest
- Four Compute windows that assign a boat number to each of the four boats identified: Compute_ID1, Compute_ID2, Compute_ID3, and Compute_ID4. This allows SAS Event Stream Processing to differentiate the boats before joining the streams together for processing.
- One Union window that unifies the boats' event streams: Union_All_Boats
- One Geofence window that defines the areas of interest: Geofence_Area_Check
- One Copy window that is used to transition the model from stateless to stateful
- Two Filter windows that identify if any of the boats have entered the exclusion zone and speed restriction zone and if any of the boats were speeding: Filter_Inside_Exclusion_Zone and Last_Speeding_Event
- Two Aggregate windows that aggregate the last exclusion violation and the last speeding event: Last_Exclusion_Violation and Last_Speeding_Event

Example Steps

Prepare the Project in SAS Event Stream Processing Studio

Before you can create a dashboard in SAS Event Stream Processing Streamviewer, you must perform the following steps in SAS Event Stream Processing Studio:

- 1 Open SAS Event Stream Processing Studio and sign in with your credentials. For more information, see [“Accessing SAS Event Stream Processing Studio” in SAS Event Stream Processing: Using SAS Event Stream Processing Studio](#).
- 2 If you are using an edge environment, perform the following steps:
 - a Ensure that an ESP server is available and configured in SAS Event Stream Processing Studio. For more information about how to start an ESP server in an edge environment, see [“Starting the ESP Server in an Edge Environment” in SAS Event Stream Processing: Using the ESP Server in an Edge Environment](#). For more information about how to add an ESP server to SAS Event Stream Processing Studio, click [“Add or Edit an ESP Server to Run on an Edge Server” in SAS Event Stream Processing: Using SAS Event Stream Processing Studio](#).

Add Subscribers to the Model

In SAS Event Stream Processing Streamviewer, add a subscriber to show data from one of the boats streaming through the model:

- 1 Click .

The Subscribers window appears.

- 2 Click .

The New ESP Subscriber window appears.

- 3 In the **Name** field, enter `Boat1`.
- 4 In the **ESP server** field, confirm that the ESP server that you added is selected by default.
- 5 In the **Project** field, confirm that `sailing_example` is selected by default.
- 6 In the **Continuous query** field, confirm that `cq1` is selected by default.
- 7 In the **Window** field, select `Boat1` from the drop-down list.
- 8 In the **Mode** field, select `Streaming` from the drop-down list.
- 9 Accept all other default selections.
- 10 Click **OK**.

A message appears, indicating that a new item has been added to the dashboard.

Add another subscriber to the model that shows the boats that enter the exclusion zone:

- 1 Click .

The New ESP Subscriber window appears.

- 2 In the **Name** field, enter `Last_Exclusion_Violation`.
- 3 In the **ESP server** field, confirm that the ESP server that you added is selected by default.
- 4 In the **Project** field, confirm that `sailing_example` is selected by default.
- 5 In the **Continuous query** field, confirm that `cq1` is selected by default.
- 6 In the **Window** field, select `Last_Exclusion_Violation` from the drop-down list.
- 7 In the **Mode** field, confirm that `Updating` is selected by default.
- 8 Accept all other default selections.
- 9 Click **OK**.

A message appears, indicating that a new item has been added to the dashboard.

Add another subscriber to the model that shows boats that have been found speeding:

- 1 Click .

The New ESP Subscriber window appears.

- 2 In the **Name** field, enter `Last_Speeding_Event`.
- 3 In the **ESP server** field, confirm that the ESP server that you added is selected by default.
- 4 In the **Project** field, confirm that **sailing_example** is selected by default.
- 5 In the **Continuous query** field, confirm that **cq1** is selected by default.
- 6 In the **Window** field, select **Last_Speeding_Event** from the drop-down list.
- 7 In the **Mode** field, confirm that **Updating** is selected by default.
- 8 Accept all other default selections.
- 9 Click **OK**.

A message appears, indicating that a new item has been added to the dashboard.

- 10 Click **Close**.

You are returned to the dashboard. The dashboard items are updated to display events associated with the window. For each window that you have subscribed to, this information appears in a table.

Examine the Model in ESP Model Viewer

- 1 Click .

The Model Viewer window appears and displays a graphical representation of the model currently running on the ESP server selected.

- 2 If a graphical representation of your model does not appear in the Model Viewer, refresh the Model Viewer. Click .

- 3 Change the model's display properties, click .

The Edit Model Display Properties window appears.

- 4 In the **Link Type** field, select **Orthogonal** from the drop-down list.
- 5 The model graph is too large to fit on a vertical view. To change to a horizontal orientation, in the **Orientation** field, select **Horizontal** from the drop-down list if it is not already selected.
- 6 Click **OK**.

The model now appears in a horizontal orientation with orthogonal edges.

- 7 Click the `Areas_Of_Interest` window on the diagram.

Clicking a window on the diagram populates the tables located at the bottom of the ESP Model Viewer with details about the window. These details include the window's incoming and outgoing data sources, its schema, and its corresponding XML code. The window that you selected is highlighted with a black border.

- 8 In the table in the bottom left corner, click `Boat1`.

The `Boat1` window is selected. Clicking a row in the table is an alternative method of selecting a window on the diagram.

Add a streaming subscriber that shows data from the Retention_30Min window streaming through the model:

1 Click the Retention_30Min window.

2 Click  to create a new streaming subscriber.

A message appears, indicating that a new item has been added to the dashboard.

3 Click **Close**.

You are returned to the dashboard. Examine the dashboard. In SAS Event Stream Processing Streamviewer, the dashboard items are updated to display events associated with the window. For each window that you have subscribed to, this information appears in a table.

Customize the Dashboard

1 Rearrange the items on the dashboard to ensure that you have a clear view of each item. To move a dashboard item, click the item's header and drag it to a different location on the dashboard.

2 Add a map to the dashboard to display the area around the marina:

a Click  in the top right corner of the Retention_30Min table.

b Click **New chart**.

The New Chart window appears. By default the settings for a vertical bar chart appear.

c In the list of options on the left, click **Map** to display the settings for a map.

d In the **Title** field, enter **Marina Map**.

e In the **Latitude** field, select **lat** from the drop-down list.

f In the **Longitude** field, select **long** from the drop-down list.

g In the **Size** field, select **speed** from the drop-down list.

h In the **Color** field, select **BoatNumber** from the drop-down list.

i Confirm that the **Show legend** check box is selected.

j Click **OK**.

The map appears on the dashboard. Each boat being tracked is represented by a circle.

k Click a circle on the map for the boat whose information you want to view.

The circle is highlighted on the map.

l Position the cursor over the boat that you selected.

A message box appears, specifying the boat's latitude, longitude, size, and speed.

Add a vertical bar chart to display the highest speed attained of each boat found to be speeding:

1 Click  in the top right corner of the Last_Speeding_Event table.

2 Click **New chart**.

The New Chart window appears.

- 3 In the list of options on the left, click **Vertical Bar** to display the settings for a bar chart.
- 4 In the **Title** field, enter `Speeding Boat Chart`.
- 5 In the **Values** field, select **Max_Speed**.
- 6 Ensure that the **X-axis title** check box is selected by default.
- 7 Select the **Y-axis title** check box.
- 8 Accept all other defaults.
- 9 Click **OK**.
The bar chart appears on the dashboard.
- 10 Position the cursor over a point on the bar chart.
A message box appears, specifying the speeding boat's number along with its maximum speed.

Save the Dashboard and Stop the Project

- 1 Click .
The Save Dashboard As window appears.
- 2 In the **Name** field, enter `SailingDashboard`.
- 3 Click **OK**.
- 4 In SAS Event Stream Processing Studio, stop the project in test mode.
The project stops and is unloaded from the ESP server. The dashboard items in SAS Event Stream Processing Streamviewer stop showing events.